

Mathematics A

General Certificate of Secondary Education

Unit **A502/02**: Mathematics B (Higher Tier)

Mark Scheme for November 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.















All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations used in the detailed Mark Scheme.

| Annotation | Meaning |
|---|---|
|  | Correct |
|  | Incorrect |
|  | Benefit of doubt |
|  | Follow through |
|  | Ignore subsequent working (after correct answer obtained), provided method has been completed |
|  | Method mark awarded 0 |
|  | Method mark awarded 1 |
|  | Method mark awarded 2 |
|  | Accuracy mark awarded 1 |
|  | Independent mark awarded 1 |
|  | Independent mark awarded 2 |
|  | Misread |
|  | Special case |
|  | Omission sign |

These should be used whenever appropriate during your marking.

The **M**, **A**, **B**, etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate these scripts to show how the marks have been awarded. It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

Subject-Specific Marking Instructions

1. **M** marks are for using a correct method and are not lost for purely numerical errors.
A marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
B marks are independent of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
SC marks are for special cases that are worthy of some credit.
2. Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.

3. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT $180 \times (\textit{their '37'} + 16)$, or FT $300 - \sqrt{(\textit{their '5^2 + 7^2'})}$. Answers to part questions which are being followed through are indicated by eg FT $3 \times \textit{their (a)}$.

For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.
5. The following abbreviations are commonly found in GCSE Mathematics mark schemes.
 - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
 - **isw** means **ignore subsequent working** after correct answer obtained and applies as a default.
 - **nfw** means **not from wrong working**.
 - **oe** means **or equivalent**.
 - **rot** means **rounded or truncated**.
 - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
 - **soi** means **seen or implied**.

6. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.
7. In questions with a final answer line following working space,
 - (i) if the correct answer is seen in the body of working and the answer given on the answer line is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.
 - (ii) if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.
 - (iii) if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.
8. In questions with a final answer line:
 - (i) If one answer is provided on the answer line, mark the method that leads to that answer.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.
9. In questions with no final answer line:
 - (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.
10. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

11. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.
12. Ranges of answers given in the mark scheme are always inclusive.
13. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.
14. Anything in the mark scheme which is in square brackets [...] is not required for the mark to be earned, but if present it must be correct.

| Question | | Answer | Marks | Part Marks and Guidance | |
|----------|-----|--|-------|---|--|
| 1 | (a) | 64, 19 | 1 | | |
| | (b) | 1200 | 1 | | |
| | (c) | 75, 25 any order | 1 | | |
| 2 | (a) | Correct reflection (-3, -1), (-1, -1), (-3, 2) | 2 | B1 for reflection in $x = -1$ | |
| | (b) | Correct rotation (1, 1), (3, 1), (3, 4) | 2 | B1 for rotation 90° or wrong centre | |
| | (c) | Correct translation (4, -1), (2, -1), (2, -4) | 3 | M1 for attempt to add the vectors A1 for $\begin{pmatrix} 5 \\ 0 \end{pmatrix}$ | eg 'along 5' Condone poor notation eg $\frac{5}{0}$ |
| 3 | (a) | 6 correct points plotted | 2 | B1 for at least 3 correct | Tolerance 2 mm Ignore any connecting lines |
| | (b) | Correct response 1 | 1 | Allow 1 for each distinct comment to a maximum of 2 | Picking out individual points scores 0 eg '88 ice creams were sold on Sat week 1' |
| | | Correct response 2 | 1 | Thurs sales generally increasing Sat sales usually more than Thurs Sat sales fall then rise From week 5 the trend in sales is upwards Sat week 4 very low or anomaly oe As the amount of weeks increase the difference between sales decreases | Inverse statements credited only once eg Sat good then Thurs not so good |

| Question | | Answer | Marks | Part Marks and Guidance | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|-----|--|--------|---|--|----|--|--|---|--|--|---|--|--|---|--|--|--|--|--|--|---|--|--|--|---|---|--|---|
| 4 | | <table border="1"> <tr> <td>Eq</td> <td>Id</td> <td>Fo</td> <td>Ex</td> </tr> <tr> <td></td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td></td> <td></td> <td></td> <td>✓</td> </tr> </table> | Eq | Id | Fo | Ex | | | ✓ | | | ✓ | | | ✓ | | | | | | | ✓ | | | | ✓ | 4 | <p>B3 for 4 correct Or B2 for 3 correct Or B1 for 2 correct</p> | If > 1 tick in a row then that counts as an incorrect entry |
| Eq | Id | Fo | Ex | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | ✓ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | Strong negative No correlation | 2 1 | B1 for negative correlation | Condone fewer than 10 crosses drawn providing correlation clear | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | (a) | 6 4 1 | 2 | B1 for one correct value | | | | | | | | | | | | | | | | | | | | | | | | | |
| | (b) | Correct ruled graph | 2 | M1 for 2 of <i>their</i> points correctly plotted or for correct line any length | Graph from 0 to 6 for 2 | | | | | | | | | | | | | | | | | | | | | | | | |
| | (c) | -0.8 to -0.5 | 2FT | <p>M1 for use of $\frac{\Delta y}{\Delta x}$ soi or rearranging to $y = mx + c$ or 0.5 to 0.8 Or SC1 for -2 to -1.25</p> | <p>$\frac{-2}{3}, \frac{2}{-3}, \frac{-4}{6}, \frac{4}{-6}$ all score 2</p> <p>If <i>their</i> line is incorrect and has negative gradient, allow M1A1FT for correct gradient of <i>their</i> line found ($\pm 15\%$) or M1 for the absolute value of its gradient. If <i>their</i> line has $m > 0$ then max M1</p> | | | | | | | | | | | | | | | | | | | | | | | | |

| Question | | | Answer | Marks | Part Marks and Guidance | | | | | | | | |
|----------|-----|-----|----------|-------|--|---|---|---|---|---|---|---|---|
| 7 | | | 45.82 | 4 | <p>B3 for digits 4582</p> <p>OR</p> <p>M1 for $395(0) + 632$ or $406(0) + 522$ (at least 1 term correct and addition attempted)</p> <p>A1 if all digits are correct in their part sums</p> <p>OR</p> <p>M1 for $3500 + 450 + 560 + 72$ (ie 4 values added, at least two terms correct)</p> <p>A1 for all digits correct, and 3 terms correct</p> <p>OR</p> <p>If grid ('Chinese' method) used</p> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">5</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">6</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">7</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">2</td> </tr> </table> <p>M1 complete grid, 2 products correct A1 whole grid correct</p> <p>Or if 0 scored, allow SC1 for attempting to multiply 5.8×7.9 or 5×8 soi</p> | 3 | 5 | 5 | 6 | 4 | 7 | 5 | 2 |
| 3 | 5 | | | | | | | | | | | | |
| 5 | 6 | | | | | | | | | | | | |
| 4 | 7 | | | | | | | | | | | | |
| 5 | 2 | | | | | | | | | | | | |
| 8 | (a) | (i) | $m > -5$ | 2 | <p>M1 for correct first step eg $2m > -4 - 6$ or better, dividing through by 2 or for $(m =, m <, <) -5$</p> | <p>Condone x, n etc used instead of m</p> | | | | | | | |

| Question | | Answer | Marks | Part Marks and Guidance | |
|----------|------|--------------------------------|-------|---|-------------------------------------|
| | (ii) | | 1FT | Condone solid circle Correct or FT from <i>their</i> attempt at an inequality only | Allow any reasonable representation |
| | (b) | 3 | 1 | | |
| 9 | (a) | 10^{24} | 2 | M1 for $10^{21} \times 1000$ oe or 10^3 seen | |
| | (b) | 10 000, ten thousand or 10^4 | 2 | M1 for $10^{27} \div 10^{23}$ or 10^{-4} seen | 0 for $27 \div 23$ |
| | (c) | $\frac{1}{10}$ | 3 | B2 for $\frac{1}{\sqrt{100}}$ or $\sqrt{\frac{1}{100}}$ Or B1 for $\frac{1}{100^{\frac{1}{2}}}$ or 10 final answer or $\sqrt{100}$ | |
| 10 | | $\frac{20}{21}$ final answer | 3 | M2 for $\frac{5}{3} \times \frac{4}{7}$ Or M1 for $\frac{5}{3}$, $\frac{4}{7}$ or $\frac{7}{4}$ seen | oe eg $\frac{20}{12}$ etc |

| Question | | | Answer | Marks | Part Marks and Guidance | |
|----------|-----|-------|---|--------|---|--|
| 11 | (a) | | $5C + 6B = 30$ | 1 | oe eg allow $6B + 5C = 30$ | Condone lower case |
| | (b) | | [C =] 3 [B =] 2.50 | 3 | M1 for multiplying one equation to get either coefficient equal (allow 1 error) A1 for either value correct Mark final answer | 3 and 2.5 can score up to 2 Correct answer with no working scores 3 |
| 12 | (a) | (i) | $\mathbf{a + b}$ or $\mathbf{b + a}$ | 1 | | Capitals, eg A and B, do not score |
| | | (ii) | $\mathbf{b - a}$ or $\mathbf{-a + b}$ | 1 | | |
| | | (iii) | $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$ oe | 2 | M1 for $\overrightarrow{OA} + \frac{1}{2}\overrightarrow{AB}$ | eg 2 for $\mathbf{a} + \frac{1}{2}(\mathbf{b - a})$ |
| | (b) | | O, M, C collinear/all on a line M is midpoint of OC oe | 1 1 | | It is an equal distance from O to M as from M to C OC is double OM OM is half of OC |

| Question | Answer | Marks | Part Marks and Guidance | |
|----------|--|---|--|--|
| 13* | <p>Correct angles with correct working and reasons, clearly laid out</p> <p>As 5 but one missing reason Or full solution with no more than 1 arithmetic error</p> <p>2 correct angles Or one correct angle with reason</p> <p>No correct work seen</p> | <p>5</p> <p>4–3</p> <p>2–1</p> <p>0</p> | <p>For the lower mark the answer will be correct with > 1 missing reasons</p> <p>For the lower mark there will be one correct angle</p> | <p>$\angle RPQ = 66^\circ$ alternate angles $\angle PQR = 66^\circ$ alt seg $e = 180 - 66 - 66$ $= 48^\circ$ angles in a triangle</p> <p>$\angle RPQ = 66^\circ$ alternate angles $\angle QRU = 66^\circ$ alt seg $e = 180 - 66 - 66$ $= 48^\circ$ angles on a straight line Condone Z for alternate angles</p> <p>Accept angles marked on diagram for 1 or 2 marks</p> |

APPENDIX 1

Question 3(b) exemplars

Comments should apply to the whole data set.

General comments should say 'usually' or 'generally' if they are not always true.

| | | |
|---|---|--|
| He usually sells more on Saturdays | 1 | |
| The no. sold on a Sat decrease then start to increase | 1 | |
| After about 6 weeks he sells more on average | 1 | |
| Week 1 had the biggest range of sales | 1 | |
| The data becomes more consistent at the end | 1 | |
| | | |
| It keeps going up and down | 0 | Not always |
| She doesn't sell much on Thurs | 0 | Compared to what? |
| The number sold on Thurs always increases | 0 | Not always |
| He sells more on Saturdays | 0 | Not always |
| He sells more on Sat week 1 than Sun week 1 | 0 | Doesn't apply to all the data (and not Sunday) |
| As the weeks went on he sold more and more each week | 0 | Not true |
| He is starting to sell more ice creams | 0 | When? |
| | | |
| There is an anomaly in his data on Week 4 | 1 | |
| It's fluctuating each Sat & Thurs except Week 4 | 1 | |
| On Thurs week 4 more sold than on Sat | 1 | |
| | | |
| There is a positive correlation | 0 | Irrelevant |

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